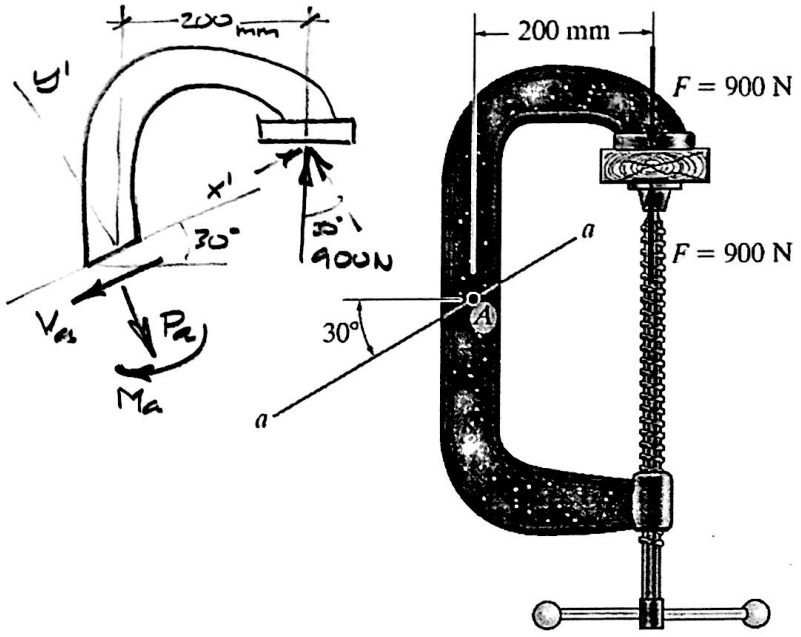
1) GIVEN: C-clamp loaded as shown.
REQ'D: Internal loads at *a-a*.



$\Sigma F_{y'} = 0$

$900\cos 30° - P_a = 0$

$P_a = \underline{779.4\ N}$ ↘

$\Sigma F_{x'} = 0$

$900\sin 30° - V_a = 0$

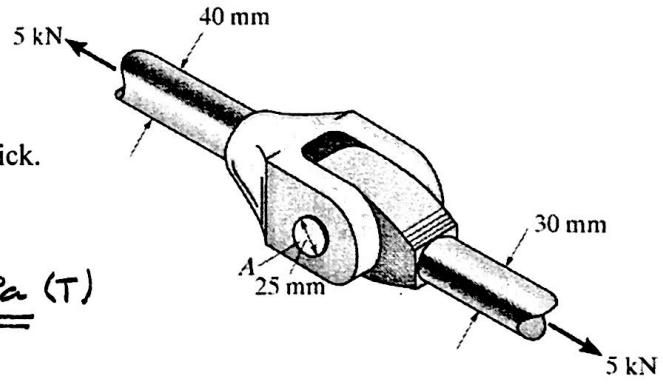
$V_a = \underline{450.0\ N}$ ↙

$\Sigma M_A = 0$

$\overleftarrow{900\,N(.2m)} - M_a = 0$

$M_a = \underline{\overrightarrow{180\ N\cdot m}}$

2) GIVEN: Yoke-and-rod connection.
REQ'D: a) Average normal stress in each rod.
b) Average shear stress in pin.
c) Bearing stress if the yoke leaves are 20mm thick.



a) FOR ⌀ 40 mm ROD

$\sigma_{40} = \frac{P_{40}}{A_{40}} = \frac{5000N}{\frac{\pi}{4}(.04m)^2} = \underline{3.98\ MPa\ (T)}$

FOR ⌀ 30 mm ROD

$\sigma_{30} = \frac{P_{30}}{A_{30}} = \frac{5000N}{\frac{\pi}{4}(.03m)^2} = \underline{7.07\ MPa\ (T)}$

b) SHEAR IN PIN

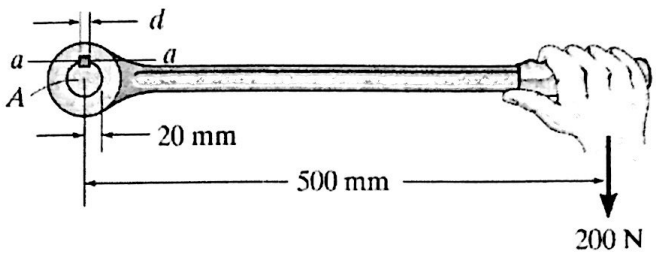
$\tau_{AVG} = \frac{P}{A_s} = \frac{5000N}{\frac{\pi}{4}(.025m)^2 \times 2} = \underline{5.09\ MPa}$ SHEAR

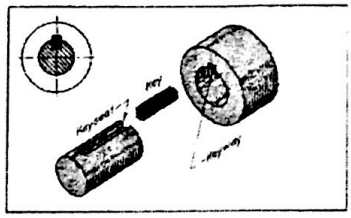
→ DOUBLE SHEAR!

c) BEARING STRESS

$\sigma_b = \frac{P}{A_b} = \frac{5000\ N}{(.025m)(.020m)\times 2} = \underline{5.00\ MPa}$ BEARING

3) GIVEN: Lever attached to shaft A with 25mm long key.
REQ'D: Minimum key width d if $\tau_{allow} = 35$ MPa.





IN EQUILIBRIUM SO:

$\Sigma M_A = 0$

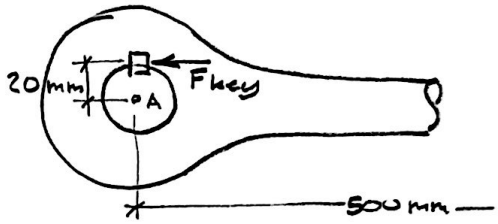
$\overleftarrow{F_{key}(.02m)} - \overrightarrow{200N(.50m)} = 0$

$F_{key} = \underline{5000\ N}$

$\tau_{allow} = \frac{P}{A_s} \Rightarrow A_s = \frac{P}{\tau_{allow}}$

$A_s = \frac{5000N}{35\times10^6\ Pa} = .14286\times10^{-3}\ m^2$

$\Rightarrow \underline{142.86\ mm^2}$

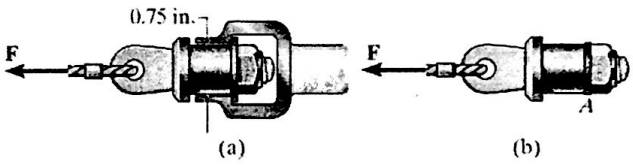


$A_s = L_{key}(d) \Rightarrow d = \frac{A_s}{L_{key}}$

$d_{req'd} = \frac{142.86\ mm^2}{25\ mm} = 5.714\ mm$

USE A 6mm SQUARE KEY 25 MM LONG

4) GIVEN: Rope swivel constructed as shown. F = 500 lb
REQ'D: Shear stress in washer if it is 1/16 in thick.



$\tau_{AVG} = \frac{F}{A_s}$

THE SHEAR AREA IS THE CIRCUMFERENCE OF THE SHEAR x THICKNESS OF WASHER.

$A_s = \pi(.75in)(.0625\ in)$

$= .1473\ in^2$

$\tau_{AVG} = \frac{P}{A_s} = \frac{500lb}{.1473\ in^2} = \underline{\underline{3.39\ ksi}}$ SHEAR